AF 3653

PATENT
109A 2948

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Art Unit: 3653
YONEZO FURUYA	Examiner: J. Shapiro
Serial No: 09/528,282	
Filed: March 17, 2000	
For: COIN INSPECTION METHOD AND APPARATUS THEREFOR	

APPEAL BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This is an Appeal from the Final Rejection from the Examiner of Group Art Unit 3653 dated November 14, 2003, rejecting claims 1-27 of the above-identified application.

REAL PARTY IN INTEREST:

The party named in the caption of the Brief is the inventor and the inventor has assigned his right, title and interest to Kabushiki Kaisha Nippon Conlux, 2-2, Uchisaiwaicho 2-chome, Chiyoda-ku, Tokyo, Japan. Such assignment was recorded at the United States Patent and Trademark Office at reel 010699, frame 0328 on March 17, 2000 and consisted of one page.

RELATED APPEALS AND INTERFERENCES:

To the best of Appellant's, Appellant's legal representatives' or Assignee's knowledge, there are no Appeals or interferences which will directly affect or be directly affected by or have any bearing on the Board's decision in the pending Appeal.

07/19/2004 SDIRETAI 00000060 09528282
01 FC:1402 330.00 OP
02 FC:1403 290.00 OP

STATUS OF THE CLAIMS:

A. Rejection of the Specification and/or Claims on Non-Reference Grounds:

None

B. Rejection of the Claims on Reference Grounds:

1. Claims 1-27 are rejected under 35 USC 102 as being anticipated by the cited art. In support of his position, the Examiner states:

"Claims 1-27 are rejected under 35 USC 102(b) as being anticipated by Martin et al., US 6,196,371".

In further support of his position, the Examiner states:

"As described in Claims 1, 6, 11, 16 and 27;

1. an exciting coil (see figure 2a, 2b, 2c and 2d, for example) arranged in the vicinity of one side of a coin passage;

2. a receiving coil (see figures 5, 6 and 11a) arranged in the vicinity of said one side of said coin passage so as to be electromagnetically coupled with said exciting coil;

3. oscillation means (1152a and b) for exciting and oscillating said exciting coil at a predetermined frequency to produce an electromagnetic field;

4. first detecting means (see figure 55c) for detecting at least one of amplitude, frequency and phase of an oscillation voltage of said exciting coil;

5. second detecting means (see figure 55c, sensors 4546a, b or c) for detecting an electromotive force signal generated in said receiving coil;

6. discriminating means (see figures 36, 37 and 38) for discriminating authenticity of the thrown coin based on detection from said first and second detecting means;

6b. *discriminating authenticity based on a combination of an electromotive force signal (4544a, b or c) detected by said receiving coil (45446a-c) and amplitude, frequency or phase of an oscillation voltage of said exciting coil (see figure 55c, for example);*

As described in Claims 2, 7, 12 and 19;

7. said predetermined frequency is set in accordance with material of the coin to be discriminated (see figure 35b);
As described in Claims 3, 8, 13 and 20;

8. said discriminating means determines material of the thrown coins based on the amplitude of the oscillation voltage of said exciting coil (see figure 35b);
As described in Claims 4, 9, 14 and 25;

9. said discriminating means samples said electromotive force signal in *a time* period, and performs a statistical process based on the sampled values to determine a figure of the thrown coin (see figure 37);
As described in Claims 10, 15 and 26;

10. said statistical process is performed by obtaining a coefficient of correlation of said sampled values with respect to a reference coin, and discriminating the thrown coin based on magnitude of said correlation coefficient (see figure 55d);
As described in Claims 5, 6, 13, 16 and 27;

11. two receiving coils having substantially identical characteristics and arranged in the vicinity of said one side of said coin passage so that said receiving coils are electromagnetically coupled with said exciting coil (see figure 56a-56h);

12. discriminating authenticity of the coin based upon at least one of amplitude, frequency and phase of oscillation voltage of said exciting coil, and an electromotive force signal *influenced by a reactive magnetic field cased by eddy currents induced on a surface of the coin when the coin passes through said electromagnetic field and* detected by said two receiving coil (note that Martin et al. discloses determining surface irregularities and properties near the surface of the coin as well as properties for different regions of a coin –see col. 2, lines 15-23);
As described in Claims 17 and 27;

12. said first detecting means includes a first detector circuit for outputting a direct voltage signal corresponding to the oscillation voltage of said exciting coil (see figures 31a-31i);

As claimed in Claims 18 and 27;

13. said second detecting means comprises a bridge circuit including said two receiving coils, a different amplifier circuit for amplifying an alternating voltage signal outputted from said bridge circuit and outputting the amplified signal, and a second detector circuit for detecting and rectifying the alternating voltage signal from said differential amplifier circuit and converting the same into a direct voltage signal corresponding to the output of said bridge circuit (see figure 12);

As described in Claims 21-23;

14. said exciting coil is arranged at a predetermined distance from said receiving coils so that a line connecting the center of magnetic poles of said exciting coil is substantially **parallel or perpendicular** with an extending direction of said coin passage, and two receiving coils are arranged above a coin rail provided with said coin passage so that a line connecting centers of said two receiving coils is substantially **parallel or perpendicular** with an extending direction of said coin passage (see figures 2c and 3);

As described in Claims 6 and 24;

15. said coin passage (2121a) is formed so that a coin passing therethrough is inclined to said one side of said coin passage where said exciting coil and said receiving coils are arranged (see figure 21)."

2. Claims 1-27 are rejected under 35 USC 103(a) as being obvious over the cited art. In support of his position, the Examiner states:

"Claims 1-27 are rejected under 35 USC 103(a) as being obvius over Martin et al. in view of Rawics-Szczerbo et al."

In further support of his position, the Examiner essentially sets forth the anticipation rejection of claims 1-27 based on Martin et al. and then states that Martin et al. does not expressly disclose the details of using the eddy currents to

detect surface patterns of coins; Rawics-Szczerbo et al. discloses using eddy currents to detect surface patterns of coins; and it would have been obvious to use the induction coils of the device of Martin et al. to detect surface patterns of coins by inducing eddy currents by one coil and detecting the resulting frequencies by another coil and to determine a surface pattern embossed on the coin as suggested by Rawics-Szczerbo et al.

STATUS OF THE AMENDMENT:

The Examiner issued a Final Office Action on November 14, 2003 and instead of responding to the Final Office Action, Appellant filed a Notice of Appeal.

SUMMARY OF THE INVENTION:

The present invention is a coin inspection method and apparatus therefor, particularly for discriminating the authenticity of coins inserted into automatic vending machines, game machines, etc. (see Field of the Invention), particularly, the detection is performed utilizing one exciting coil 1 and two receiving coils 2a and 2b which are arranged along a passage wall 7a on one side of the coin passage 6. The coin passage 6 is sloped at a predetermined angle to allow a coin 3 to roll down while being guided by the passage wall 7a (see page 5, line 21-page 6, line 1). These receiving coils 2a and 2b are arranged above the coin rail 4 at a predetermined distance from each other and are below and separate and apart from the exciting coil 1 (see page 6, lines 10, 11, 14 and 15). The exciting coil 1 and the receiving coils 2a and 2b are arranged as described above so as to be electromagnetically coupled by means of an electromagnetic field produced by excitation of the exciting coil 1 (see page 6, lines 24-26). An oscillator 11 excites the exciting coil 1 at a predetermined frequency which preferably is one which the electromagnetic field does not penetrate into the coin, preferably in the range of 70 to 90 kHz (see page 10, lines 23-26).

When a coin 3 passes through the coin passage 6 and is located near the exciting coil 1, an eddy current is generated within the coin 3 so that the magnetic flux in the exciting coil 1 is hindered by the reactive magnetic field produced by the eddy current, leading to a change in the amplitude, frequency and phase of the oscillation voltage at both ends of the exciting coil 1 (see page 7, lines 13-18).

When the coin 3 is acted upon by the electromagnetic field generated by the exciting coil 1 which is excited by the oscillator 11, the eddy current is induced in the vicinity of the surface of the coin 3 and with an increase in excitation frequency, the eddy current is generated essentially in the vicinity of the outer periphery of the coin due to skin effect (see page 8, lines 3-7). In particular, when the coin 3, which is a conductive material, moves through the magnetic field produced by the excitation of the exciting coil 1, an inductive electromagnetic force is generated by the eddy current as the induced current flows on the surface of the coin 3. As a result of Lenz's law, the eddy current as the induced current is in a direction such that a magnetic field produced by the induction current prevents the change of the magnetic flux produced by the exciting coil 1. This magnetic field produced by the induced current in the coin 3 is the reactive magnetic field (see page 8, lines 8-15).

The reactive magnetic field interacts with the receiving coils 2a, 2b according to a subtle change of the contour features of the coin surface. In each of the receiving coils 2a and 2b is produced a signal in the receiving coils 2a, 2b corresponding to the change of the active magnetic field indicative of the contour features of the coin 3 and this signal is the "detection signal" (see page 8, lines 16-23).

Based on the detection signal of the receiving coils 2a and 2b, a corresponding alternating voltage signal is generated in a bridge circuit 14 including the receiving coils 2a and 2b which is outputted to a differential amplifier 15. The differential amplifier 15 amplifies the alternating voltage signal generated by the bridge circuit 14, and outputs the amplified signal to a second detector circuit 13b which outputs a direct voltage signal corresponding to the detection signal to the inspection means 16 (see page 9, lines 6-14). The inspection means 16 supplies the direct voltage signal to an A/D converter 17 and the A/D converter 17 converts the direct voltage signal into a digital signal of a corresponding voltage and the digital signal is outputted to a signal inspection circuit 18 which determines whether or not the coin 3 has a desired feature and outputs the resultant (see page 9, lines 14-20).

REFERENCES CITED:

A. Martin et al., USP 6,196,371

Appellant has carefully reviewed Martin et al. and respectfully submits that Martin et al. discloses a coin discrimination apparatus which includes a sensor comprising a circular core 214

(see Figs. 2A, 2B and 2C) having a gap 216 provided therein. A low frequency excitation coil 220 is wound on the core 214 and a high frequency excitation coil 242 is also wound on the same core 214, but separated into two separate high frequency excitation coils 242a and 242b. The coin 224 moves down the rail 232 and passes through the gap 216 of the core 214.

A low frequency excitation signal is applied to the coil 220 and a high frequency signal is applied by an oscillator to the high frequency excitation coil 242 so as to create an intense electromagnetic field in the gap 216 through which the coin 224 passes.

As the coin 224 passes through the electromagnetic field in the gap 216, the coin 224 causes a change in the frequency and phase of the high and low frequency excitation signals applied to the coils 220 and 242 since the coin is metallic. This change in the phase and frequency in the low frequency excitation signal and the high frequency excitation signal are detected by the phase lock circuits associated with the coils 220 and 242 and it is from this detected phase and frequency change in the low frequency and high frequency excitation signals which allows the apparatus to discriminate the type of coin.

Consequently, Appellant respectfully submits that Martin et al. does not disclose a separate exciting coil and a receiving coil both provided on the same side of the coin passage and that a reactive electromagnetic field created by the induced eddy currents in the surface of the coin would be detected by the separate receiving coil to determine or discriminate the denomination of the coin.

B. Rawics-Szczerbo et al., USP 4,754,862

Rawics-Szczerbo et al. discloses a metallic article discriminator which includes first, second and third sensor or exciting coils 2, 3 and 4. The sensor coil 2 is disposed on one side of the coin passageway such that its axis extends orthogonal to the plane of the major surface of the coin and is generally larger in the maximum diameter of coins which pass through the passageway 1. The second coil 3 is disposed on the opposite side of the coin passage 1 from that of the coil 2. The third coil 4 is arranged to wrap around the passageway such that the axis of the coil 4 is parallel to the length of the passageway. All three coils 2, 3 and 4 are excited at different frequencies and all three coils 2, 3 and 4 are utilized to discriminate the coin denominations and a counterfeit coin.

The discrimination is performed by allowing a coin to roll past the coils 2 and 3 and through the coil 4. As the coin rolls past the coils 2 and 3 and through the coil 4, the resonant

frequency of the circuits 10, 11 and 12 of which the coils 2, 3 and 4 are respectively part is varied as a result of a change in the impedance by virtue of skin effect type eddy currents induced by the coil in the coin and the magnitude and frequency of the excitation signal in each one of the resonant circuits 10, 11 and 12 will vary depending upon the relative sizes of the coil and the coin, the coin diameter and thickness, the metal from which the coin is made and the surface pattern embossed upon the coin. It is this change in frequency and amplitude of the respective resonant circuits 10, 11 and 12 which is used to determine or discriminate the different coin denominations and counterfeit coins.

Consequently, Appellant respectfully submits that similar to Martin et al., Rawics-Szczerbo et al. does not disclose a separate exciting coil and a receiving coil both provided on the same side of the coin passage and that a reactive electromagnetic field created by the induced eddy currents in the surface of the coin would be detected by the separate receiving coil to determine or discriminate the denomination of the coin.

ISSUES:

A. Claims 1-27 were finally rejected by the Examiner as being anticipated by Martin et al. and it is Appellant's position that Martin et al. does not show each and every element of Appellant's invention.

B. Claims 1-27 were finally rejected by the Examiner as being obvious over Martin et al. in view of Rawics-Szczerbo et al. and it is Appellant's position that the combination of Martin et al. and Rawics-Szczerbo et al. does not show or suggest each and every element of Appellant's invention and one of ordinary skill in the art, knowing the teachings of Martin et al. and Rawics-Szczerbo et al. would not have made Appellant's invention.

GROUPING OF THE CLAIMS:

The claims of each group stand or fall together.

ARGUMENT:

A. Claims 1-27 are not anticipated by Martin et al.

For the claims to be invalid under 35 USC 102, anticipation, all of the elements of that claim must be shown in the single reference. Appellant respectfully submits that Martin et al.

does not disclose each and every element of Appellant's invention as claimed for the reasons set forth below.

In particular, Appellant respectfully submits that Martin et al. does not disclose separate exciting coil and receiving coils as is required by Appellant's claimed invention. In addition, in Martin et al. the exciting coil is provided on a core 214 which is circular and which has a gap through which the coin passes. As a result, the exciting coil is on both sides of the coin. In contrast thereto, in Appellant's invention the exciting coil and the receiving coil are provided on the same side and neither is provided on both. Still further, Appellant respectfully submits that there is not even a receiving coil and instead there are only a low frequency exciting coil and a high frequency exciting coil provided on the core.

In addition, Appellant respectfully submits that the operation of Martin et al. is entirely different from that of Appellant's invention and this difference of operation results in a different structure. In particular, in Martin et al. the coin passes through an intense field provided in the gap 216 of the core 214 and this causes a variation in the frequency and phase of the excitation frequency from the oscillator which is applied to the exciting coil. Clearly, there is no showing or suggestion in Martin et al. that there would be a reactive magnetic field created by the induced eddy current in the surface of the coin 3 which would be sensed by a receiving coil so as to be able to discriminate the coin, all of which is required by Appellant's invention as particularly claimed in Appellant's independent claims 1, 11, 16 and 27. Appellant respectfully submits that because of the large electromagnetic field created in the exciting coil by the oscillator, any variations in the electromagnetic field caused by the reactive magnetic field would be swamped and undetectable by the exciting coil to which the oscillator applies the exciting signal.

Still further and as is admitted by the Examiner in the Examiner's obviousness rejection, nowhere in Martin et al. does it discriminate the coin based upon the surface pattern of the coin passing by the exciting coil and the receiving coil.

In view of the above, therefore, Appellant respectfully submits that Martin et al. does not disclose each and every element of Appellant's claims for at least the reasons given above and claims 1-27 are not anticipated thereby.

B. Claims 1-27 are not obvious over the combination of Martin et al. and Rawics-Szczerbo et al.

In order to determine obviousness, one must apply the well known test for obviousness as set forth in the U.S. Supreme Court case entitled Graham v. John Deere. In this case, the U.S. Supreme Court enunciated a four-part test which require that the invention as a whole be carefully reviewed and analyzed. Looking at this four-part test, Appellant respectfully submits that there are significant differences between Appellant's invention and the prior art relied upon by the Examiner and that such differences between the prior art and Appellant's invention would not have been obvious to one of ordinary skill in the art for the reasons set forth below.

So as not to bore the Board of the Appeals and Interferences, Appellant would like to incorporate by reference the Examiner's comments above concerning Appellant's invention and Martin et al. and merely directed Appellant's arguments to the secondary reference to Rawics-Szczerbo et al. In particular, the Examiner has already admitted in his Final Office Action that Martin et al. does not disclose details of using eddy currents to detect surface patterns of coins and relies upon the teachings of Rawics-Szczerbo et al.

Appellant has carefully reviewed Rawics-Szczerbo et al. and respectfully submits that while Rawics-Szczerbo et al. may mention eddy currents at col. 6, lines 4-6, the eddy currents are one of many elements described as functioning together which cause a change in impedance in the first, second and third exciting coils as the coin passes thereby or through and which therefore causes a change in the amplitude and frequency of the resonant circuits to which the first, second and third exciting coils are part. In particular, the magnitude of the frequency and amplitude deviations in the resonant frequencies of the resonant circuits of which the first, second and third exciting coils are part is dependent upon the relative sizes of the coil in the coin, the coin diameter and thickness, the metal from which the coin is made and the surface pattern embossed on coin. While all these may be true, Appellant respectfully submits that in Rawics-Szczerbo et al. it expressly states that the detection accuracy is dependent on the arrangement and structure of the coils used for the discrimination or detection, namely the first coil which is provided on one side and is larger than the coin, the second coil which is provided on the other side and a third coil provided concentric with the coin passageway through which the coin passes. As a result, Appellant respectfully submits that any detection signal representing the surface pattern of the coil is extremely small compared with the magnitude of the magnetic flux of the exciting coil itself and the variations of the frequency and amplitude caused by the relatively larger influences such as coin diameter and thickness and the metal from which the

coin is made. Still further, Appellant respectfully submits that Rawics-Szczerbo et al., similar to Martin et al., does not have a separate receiving coil and also does not detect such with a separate receiving coil that a reactive magnetic field is generated by the induced eddy current in the surface of the coin.

In view of the above, therefore, Appellant respectfully submits that if one of ordinary skill in the art were to combine the teachings of Martin et al. and Rawics-Szczerbo et al., the resultant combination would not have a separate receiving coil and there would be no detection of the reactive magnetic field generated by the induced eddy current in the surface of the coin and which would then be detected by the receiving coil.

In view of the above, therefore, Appellant respectfully submits that claims 1-27 are not obvious over Martin et al. in view of Rawics-Szczerbo et al.

CONCLUSION:

The finally rejected claims 1-27 of Appellant's application are respectfully submitted as clearly allowable for the reasons as set forth as follows:

1. Claims 1-27 are not anticipated by the cited art.

2. Claims 1-27 are not obvious over the cited art.

3. Allowance of claims 1-27 is earnestly solicited.

3. An Oral Hearing is requested and a check in the sum of $290.00 as the fee is submitted herewith.

4. Also, a check in the sum of $330.00 as the filing fee for the Appeal Brief and the Appeal Brief in triplicate is submitted herewith.

Please charge any additional costs incurred by or in order to implement this Appeal Brief or required by any requests for extensions of time to KODA AND ANDROLIA DEPOSIT ACCOUNT NO. 11-1445.

Respectfully submitted,

KODA & ANDROLIA

By: _____
William L. Androlia
Reg. No. 27,177

2029 Century Park East
Suite 1430
Los Angeles, CA 90067-3024
Tel: (310) 277-1391
Fax: (310) 277-4118

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to:
Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on

July 14, 2004
Date of Deposit

William L. Androlia
Name

_____ 7/14/2004
Signature Date

APPENDIX

THE REJECTED CLAIMS UPON WHICH APPEAL I S TAKEN:

1. A method of inspecting a coin thrown into a machine, comprising the steps of:

(a) arranging an exciting coil and a receiving coil separately from each other in the vicinity of one side of a coin passage so that said exciting coil and said receiving coil are electromagnetically coupled with each other;

(b) exciting said exciting coil to oscillate at such a frequency that an electromotive force influenced by a reactive magnetic field caused by eddy current induced on a surface of the thrown coin when the coin passes through an electromagnetic field produced by said exciting coil is detected by said receiving coil to determine a surface pattern of the thrown coin, and detecting at least one of amplitude, frequency and phase of an oscillation voltage of said exciting coil; and

(c) discriminating authenticity of the thrown coin based on a combination of an electromotive force signal detected by said receiving coil and at least one of the detected amplitude, frequency and phase of an oscillation voltage of said exciting coil.

2. A method of inspecting a coin according to claim 1, wherein said frequency in said step (b) is preset in accordance with material of the coin to be inspected.

3. A method of inspecting a coin according to claim 1, wherein said step (c) includes a step of determining material of the thrown coin based on the amplitude of the oscillation voltage of said exciting coil.

4. A method of inspecting a coin according to claim 1, wherein said step (c) includes the steps of sampling said electromotive force signal in a time period, and performing a statistical process based on the sampled values to determine a feature of the thrown coin.

5. A method of inspecting a coin according to claim 4, wherein said statistical process includes the steps of obtaining a coefficient of correlation of said sampled values with respect to a reference coin, and discriminating the thrown coin based on magnitude of said correlation coefficient.

6. A method of inspecting a coin thrown into a machine, comprising the steps of:

(a) arranging an exciting coil in the vicinity of one side of a coin passage inclined at a predetermined angle so that magnetic poles thereof face the coin passage;

(b) arranging two receiving coils with substantially identical characteristics in the vicinity of said one side of said coin passage but separately from said exciting coil so that said receiving coils are electromagnetically coupled with said exciting coil;

(c) exciting said exciting coil at a predetermined frequency to produce an electromagnetic field, and detecting at least one of amplitude, frequency and phase of electromagnetic field of said exciting coil; and

(d) discriminating authenticity of the thrown coin based on a combination of an electromotive force signal influenced by a reactive magnetic field caused by eddy current induced on a surface of the thrown coin and detected by said two receiving coils and at least one of amplitude, frequency and phase of an oscillation voltage of said exciting coil.

7. A method of inspecting a coin according to claim 6, wherein said frequency in said step (c) is preset in accordance with material of the coin to be inspected.

8. A method of inspecting a coin according to claim 6, wherein said step (d) includes a step of determining material of the thrown coin based on the amplitude of the oscillation voltage of said exciting coil.

9. A method of inspecting a coin according to claim 6, wherein said step (d) includes the steps of sampling said electromotive force signal in a time period, and performing a statistical process based on the sampled values to determine a feature of the thrown coin.

10. A method of inspecting a coin according to claim 9, wherein said statistical process includes the steps of obtaining a coefficient of correlation of said sampled values with respect to a reference coin, and discriminating the coin based on magnitude of said correlation coefficient.

11. An apparatus for inspecting a coin thrown into a machine, comprising:

an exciting coil arranged in the vicinity of one side of a coin passage;

a receiving coil arranged separately from said exciting coil in the vicinity of said one side of said coin passage so as to be electromagnetically coupled with said exciting coil;

oscillation means for exciting and oscillating said exciting coil at a predetermined frequency to produce an electromagnetic field;

first detecting means for detecting at least one of amplitude, frequency and phase of an oscillation voltage of said exciting coil;

second detecting means for detecting an electromotive force signal influenced by a reactive magnetic field caused by eddy currents induced on a surface of the thrown coin when

the coin passes through said electromagnetic field produced by said exciting coil and which is generated in said receiving coil; and

discriminating means for discriminating authenticity of the thrown coin based on detection outputs from said first and second detecting means;

whereby authenticity of the thrown coin is discriminated based on a combination of an electromotive force signal detected by said receiving coil to determine a surface pattern of the thrown coin and at least one of amplitude, frequency and phase of the oscillation voltage of said exciting coil.

12. An apparatus for inspecting a coin according to claim 11, wherein said predetermined frequency is set in accordance with material of the coin to be discriminated.

13. An apparatus for inspecting a coin according to claim 11, wherein said discriminating means determines material of the thrown coin based on the amplitude of the oscillation voltage of said exciting coil.

14. An apparatus for inspecting a coin according to claim 11, wherein said discriminating means samples said electromotive force signal in a time period, and performs a statistical process based on the sampled values to determine a feature of the thrown coin.

15. An apparatus for inspecting a coin according to claim 14, wherein said statistical process is performed by obtaining a coefficient of correlation of said sampled values with respect to a reference coin, and discriminating the thrown coin based on magnitude of said correlation coefficient.

16. An apparatus for inspecting a coin thrown into a machine, comprising:

an exciting coil arranged in the vicinity of one side of a coin passage inclined at a predetermined angle so that magnetic poles thereof face the coin passage;

two receiving coils having substantially identical characteristics and arranged separately from said exciting coil in the vicinity of said one side of said coin passage so that said receiving coils are electromagnetically coupled with said exciting coil;

oscillation means for exciting and oscillating said exciting coil at a predetermined frequency to produce an electromagnetic field;

first detecting means for detecting at least one of amplitude, frequency and phase of an oscillation voltage of said exciting coil;

second detecting means for detecting an electromotive force signal influenced by a reactive magnetic field caused by eddy currents induced on a surface of the thrown coin when the coin passes through said electromagnetic field and which is generated in said two receiving coils; and

discriminating means for discriminating authenticity of the thrown coin based on detection outputs from said first and second detecting means; and

whereby authenticity of the thrown coin is discriminated based on a combination of an electromotive force signal detected by said receiving coil to determine a surface pattern of the thrown coin and at least one of amplitude, frequency and phase of the oscillation voltage of said exciting coils.

17. An apparatus for inspecting a coin according to claim 16, wherein said first detecting means includes a first detector circuit for outputting a direct voltage signal corresponding to the oscillation voltage of said exciting coil.

18. An apparatus for inspecting a coin according to claim 16, wherein said second detecting means comprises a bridge circuit including said two receiving coils, a differential amplifier circuit for amplifying an alternating voltage signal outputted from said bridge circuit and outputting the amplified signal, and a second detector circuit for detecting and rectifying the alternating voltage signal from said differential amplifier circuit and converting the same into a direct voltage signal corresponding to the output of said bridge circuit.

19. An apparatus for inspecting a coin according to claim 16, wherein said predetermined frequency is set in accordance with material of the coin to be inspected.

20. An apparatus for inspecting a coin according to claim 16, wherein said discriminating means discriminates material of the thrown coin based on the amplitude of the oscillation voltage of said exciting coil.

21. An apparatus for inspecting a coin according to claim 16, wherein said exciting coil is arranged at a predetermined distance from said receiving coils so that a line connecting centers of magnetic poles of said exciting coil is substantially parallel with an extending direction of said coin passage, and said two receiving coils are arranged above a coin rail provided with said coin passage so that a line connecting centers of said two receiving coils is substantially parallel with an extending direction of said coin passage.

22. An apparatus for inspecting a coin according to claim 16, wherein said exciting coil is arranged at a predetermined distance from said receiving coils so that a line connecting centers of magnetic poles of said exciting coil is substantially perpendicular to an extending direction of said coin passage, and said two receiving coils are arranged above a coin rail provided with said coin passage so that a line connecting centers of said two receiving coils is substantially parallel with an extending direction of said coin passage.

23. An apparatus for inspecting a coin according to claim 16, wherein said exciting coil is arranged at a predetermined distance from said receiving coils so that a line connecting centers of magnetic poles of said exciting coil is substantially parallel with an extending direction of said coin passage, and said two receiving coils are arranged above a coin rail provided with said coin passage so that a line connecting centers of said two receiving coils is substantially perpendicular to an extending direction of said coin passage.

24. An apparatus for inspecting a coin according to claim 16, wherein said coin passage is formed so that a coin passing therethrough is inclined to said one side of said coin passage where said exciting coil and said receiving coils are arranged.

25. An apparatus for inspecting a coin according to claim 16, wherein said discriminating means samples said electromotive force signal in a time period, and performs a statistical process based on the sampled values to determine a feature of the thrown coin.

26. An apparatus for inspecting a coin according to claim 21, wherein said statistical process is performed by obtaining a coefficient of correlation of said sampled values with respect to a reference coin, and discriminating the coin based on magnitude of said correlation coefficient.

27. An apparatus for inspecting a coin thrown into a machine, comprising:

an exciting coil arranged in the vicinity of one side of a coin passage inclined at a predetermined angle so that two magnetic poles thereof face the coin passage;

two receiving coils having substantially identical characteristics and arranged separately from said exciting coil in the vicinity of said one side of said coin passage so that said receiving coils are electromagnetically coupled with said exciting coil;

oscillation circuit means arranged with said exciting coil as an oscillation element;

first detector circuit means coupled to said oscillation circuit means for detecting at least one of amplitude, phase and frequency of an oscillation voltage in said exciting coil;

bridge circuit means arranged to include said receiving coils;

differential amplifier means connected to said bridge circuit means;

second detector circuit means for detecting an electromotive force signal influenced by a reactive magnetic field caused by eddy currents induced on a surface of the thrown coin an output of said second detector circuit means being connected to said differential amplifier means; and

discriminating means connected to said first and second detector circuit means to discriminate a feature of said thrown coin based upon a combination of an output of said second detector circuit means to determine a surface pattern of the thrown coin and an output of said first detector circuit means to determine at least one of amplitude, phase and frequency of said oscillation voltage, and output a result of the discrimination.